

CHAPTER 1

INTRODUCTION

1.1 Micro Hydro Power

Hydro power was an output that derived from the water flow energy to be harness for generating useable energy. From the ancient time, people had started to invent a simple hydro system for daily purpose. The ideas of the system eventually move along with the time flow where more brilliant innovation has been made until the advance technology evolution. On this modern day, hydro power has become a huge impact towards the community.

Electricity generation was one of the main reasons on the innovation of hydro power. There were various type of hydro power that been invented with wide range of capacity. For example, the conventional hydroelectric, referring to hydroelectric dam, run-of-the-river hydroelectric, which capture the kinetic energy in river or stream without using the dam, small hydro project which often have no artificial reservoirs, micro hydro project that could consume small output of power at rural area, and pump-storage hydroelectric where it stores water pumped during periods of low demand while released for generation when demand was high.

The micro hydro power was one of the most general hydro powers that had been implemented in the isolated community which live away from the grid. This type of hydro power typically produces up from 4 kW to 100 kW of electricity using the natural flow of the water. The amount of electric power can be enough to supply a home or even small business facility. The component consists inside micro hydro power was a turbine which connected with shaft and small scale generator for transforming the

rotational energy into electric energy. For most of the micro hydropower, there were few common turbine blade type used such as Francis blade, Pelton blade, Kaplan blade, Archimedes blade and etc. the Archimedes blade usually used on low head with high water flow condition. The blade can work efficiently up to on heads as low as 1 meter. The maximum turbine efficiency that can be performed by the Archimedes blade was up to 90 percent as the flow rate increased. Single screws could work on heads up to 8 meters, but above the head level, multiple screws are generally used. Three screw blades were commonly found for this type of hydro power.

As for the conclusion, the Archimedes or screw runner for micro hydro power could consume higher efficiency similar with other type of hydro turbine. Even so the main purpose of the micro hydro turbine was to generate enough amount of electricity for the comfort of certain community that live at rural region in this world.

1.2 Archimedes Screw Turbine

Micro hydropower could consume electricity with higher in turbine efficiency even the turbine type used was low head turbine especially for Archimedes screw turbine. The Archimedean screw pump was one of the oldest hydraulic machines. Today, it was employed in pumping as well as operating in reverse in an energy conversion role for producing useful energy. Despite its age, no consistent theory links the screw's geometry with its mechanical efficiency. The research on the fatigue crack towards the Archimedes blade also still in finding and thus for obtaining the problem solution more of this low head turbine had been implemented at all around the world. Even so, this type of turbine only been implemented at rural area where the community lives were far away from the main grid. This also due to the other used of turbine that produce much more energy compare to Archimedes crew turbine. Thus in order encounters the entire problem related with Archimedes blade, the implementation of the turbine was very important for elaborating the solution for each of the problem that will occur in a normal operating turbine blade.

1.3 Problem Statements

The loss of turbine efficiency on the micro hydro power was caused from the crack occur on the turbine blade. The type of turbine blade that used for the micro hydro power was Archimedes screw blade. An analysis has to be made on the fluid flow behavior towards the blade to obtain the prediction of flow where the probability of crack might happen.

1.4 Objectives

The objectives for this project were:-

- Developed the CAD model blade using the existing blade dimension.
- To study the behavior of fluid flow acting at the screw runner.
- To predict the crack behavior to the screw runner blade of Micro Hydro Power.

1.5 Scopes

In order to accomplish the project objectives, the scopes that need to be listed for the project were as follows,

1. Develop CAD model of the screw runner blade with dimension based from the previous researcher.
2. Meshing the develop CAD model using the ANSYS CFX software.
3. Assuming the fluid medium for the analysis as water in steady state flow, isothermal condition, and isentropic condition.
4. Creating the boundary details for the analysis of the model where the boundary was based on real structure.
5. K epsilon turbulence model will be taken as the solver of the analysis.
6. The flow velocity used is at 2.5 m/s assuming the flow of the river in Malaysia.